Future Generation Computer Systems 56 (2016) 623–639

Contents lists available at ScienceDirect

Future Generation Computer Systems

journal homepage: www.elsevier.com/locate/fgcs

Mobile crowdsensing as a service: A platform for applications on top of sensing Clouds

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HIGHLIGHTS

- Emulation of deployment comparing (i) prototype of MCSaaS and (ii) current practices.
- Modeling of MCSaaS paradigm by Petri nets and evaluation against conventional MCS.
- Description of architectural elements of the platform and their interactions.
- MCSaaS platform for mass deployment of MCS apps, and their elastic user base adaptation.
- Mobile crowdsensing as a service paradigm for MCS apps design and deployment.

ARTICLE INFO

Article history:
Received 22 November 2014
Received in revised form
11 September 2015
Accepted 12 September 2015
Available online 9 October 2015

Keywords:
Cloud
IoT
Infrastructure as a Service
Volunteer contribution
Sensors and actuators
Runtime customization

ABSTRACT

Consumer-centric mobile devices, such as smartphones, are an emerging category of devices at the edge of the Internet. Leveraging volunteers and their mobiles as a (sensing) data collection outlet is known as Mobile Crowd Sensing (MCS) and poses interesting challenges, with particular regard to the management of sensing resource contributors, dealing with their subscription, random and unpredictable join and leave, and node churn.

To facilitate and expedite the (commercial) exploitation of this trend, in this paper we propose to adopt a service-oriented approach to cope with MCS application deployment into a sensing Cloud infrastructure, decoupling the MCS application domain from the infrastructure one. To this purpose we provide the building blocks for implementing such a novel take on MCS, which from a Cloud layering perspective can be identified as a platform service, i.e., an MCS as a service (MCSaaS). A prototype implementation that serves as a blueprint and a proof-of-concept of the proposed framework is presented, while an evaluation of the effectiveness of the MCSaaS paradigm has been provided using suitable mobility-related use cases for a validation of the concept, as well as a modeling approach through the adoption of generalized stochastic Petri nets.

1. Introduction and motivations

Current trends, with specific regard to cyber physical systems and Internet of Things (IoT), suggest that one of the most interesting thrusts towards pervasive services comes from opportunistic and participatory sensing paradigms, such as Mobile Crowd Sensing (MCS). MCS leverages the pervasiveness of smartphones and other portable devices, enabling users and community groups to collectively share data from onboard sensing resources so as to measure phenomena of common interest, exploiting social dynamics. The contributor has also the possibility to augment raw data with context as metadata. This community-driven sensing trend is brought about by machine interactions at different levels, including data communications, collection, processing and mining. Commencing crowd-sourcing and sensing duties from mobiles, involving device owners as volunteering participants, potentially renders end users both contributors and consumers of large volumes of (curated) data.

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http://dx.doi.org/10.1016/j.future.2015.09.017
0167-739X/